SEQUENCE LISTING

<110> Pioneer HiBred International
Bulla, Lee A.

<120> RECEPTOR FOR A BACILLUS THURINGIENSIS
TOXIN

<130> 27112-20037.13

<140> 09/457,864
<141> 1999-12-10

<150> US 08/326,117
<151> 1994-10-19

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aatcatctgc agctgcgaaa tcatctgcag cagcaaaagc atcttcagga gcgagaaaag    180
ccccaaataa tgtgag atg gca gtt gac gtc cga atc gct gcc ttc ctg ctg    232
                  Met Ala Val Asp Val Arg Ile Ala Ala Phe Leu Leu
                   1               5                  10

gtg ttt ata gcg cct gca gtt tta gct caa gag aga tgt ggg tat atg      280
Val Phe Ile Ala Pro Ala Val Leu Ala Gln Glu Arg Cys Gly Tyr Met
         15                  20                  25

acc gcc atc cca agg cta cca cga ccg gat aat ttg cca gta cta aat      328
Thr Ala Ile Pro Arg Leu Pro Arg Pro Asp Asn Leu Pro Val Leu Asn
     30                  35                  40

ttt gaa ggc cag aca tgg agt cag agg ccc ctg ctc ccc gcc ccg gag      376
Phe Glu Gly Gln Thr Trp Ser Gln Arg Pro Leu Leu Pro Ala Pro Glu
 45                  50                  55                  60

cgg gat gac ctg tgc atg gac gcc tac cac gtg ata aca gcc aac ctc      424
Arg Asp Asp Leu Cys Met Asp Ala Tyr His Val Ile Thr Ala Asn Leu
                 65                  70                  75

ggc acg cag gtc atc tac atg gat gaa gag ata gaa gac gaa atc acc      472
Gly Thr Gln Val Ile Tyr Met Asp Glu Glu Ile Glu Asp Glu Ile Thr
             80                  85                  90
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atc gcc ata ctt aat tat aac gga cca tca act ccg ttc att gaa ctg      520
Ile Ala Ile Leu Asn Tyr Asn Gly Pro Ser Thr Pro Phe Ile Glu Leu
         95                 100                 105

cca ttt tta tcc ggt tcg tac aat ctg ctg atg ccg gtc atc agg aga      568
Pro Phe Leu Ser Gly Ser Tyr Asn Leu Leu Met Pro Val Ile Arg Arg
    110                 115                 120

gtt gac aac ggg gag tgg cat ctc atc atc acg caa aga cag cat tac      616
Val Asp Asn Gly Glu Trp His Leu Ile Ile Thr Gln Arg Gln His Tyr
125                 130                 135                 140

gag ttg ccc ggc atg cag cag tac atg ttc aat gtg cgc gtg gac ggc      664
Glu Leu Pro Gly Met Gln Gln Tyr Met Phe Asn Val Arg Val Asp Gly
                145                 150                 155

cag tcg ctg gtg gca ggc gtg tct ctc gct atc gtc aac ata gat gac      712
Gln Ser Leu Val Ala Gly Val Ser Leu Ala Ile Val Asn Ile Asp Asp
            160                 165                 170

aac gcg ccc atc ata caa aac ttc gag cct tgc cgg gtt cct gaa ctg      760
Asn Ala Pro Ile Ile Gln Asn Phe Glu Pro Cys Arg Val Pro Glu Leu
        175                 180                 185

ggc gag cca ggg ttg aca gaa tgc aca tac caa gta tcg gac gcg gac      808
Gly Glu Pro Gly Leu Thr Glu Cys Thr Tyr Gln Val Ser Asp Ala Asp
    190                 195                 200

gga cgg atc agc aca gag ttc atg acg ttc agg atc gac agc gtt cgt      856
Gly Arg Ile Ser Thr Glu Phe Met Thr Phe Arg Ile Asp Ser Val Arg
205                 210                 215                 220

ggc gac gag gag acc ttc tac atc gaa cgg acg aat atc ccc aac caa      904
Gly Asp Glu Glu Thr Phe Tyr Ile Glu Arg Thr Asn Ile Pro Asn Gln
                225                 230                 235

tgg atg tgg cta aat atg acc ata ggc gtt aat acc tcg ctc aac ttc      952
Trp Met Trp Leu Asn Met Thr Ile Gly Val Asn Thr Ser Leu Asn Phe
            240                 245                 250

gtc acc agt ccg ctg cat ata ttc agc gtg aca gcc ctg gac tcg ctc     1000
Val Thr Ser Pro Leu His Ile Phe Ser Val Thr Ala Leu Asp Ser Leu
        255                 260                 265

ccg aac acc cac acg gtg act atg atg gtg caa gtg gcg aat gtg aac     1048
Pro Asn Thr His Thr Val Thr Met Met Val Gln Val Ala Asn Val Asn
    270                 275                 280

agc cgt ccg ccg cgc tgg ctg gag atc ttc gct gtc caa cag ttt gaa     1096
Ser Arg Pro Pro Arg Trp Leu Glu Ile Phe Ala Val Gln Gln Phe Glu
285                 290                 295                 300

gag aaa tct tac caa aac ttc aca gtg agg gcg atc gac gga gac act     1144
Glu Lys Ser Tyr Gln Asn Phe Thr Val Arg Ala Ile Asp Gly Asp Thr
                305                 310                 315
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gag atc aat atg cct atc aac tac agg ctg atc aca aat gag gaa gac     1192
Glu Ile Asn Met Pro Ile Asn Tyr Arg Leu Ile Thr Asn Glu Glu Asp
            320                 325                 330

aca ttc ttc agc att gag gcc ctg cct ggt gga aaa agc ggg gct gta     1240
Thr Phe Phe Ser Ile Glu Ala Leu Pro Gly Gly Lys Ser Gly Ala Val
        335                 340                 345

ttc ctc gtg tcg cca att gac cgc gac aca ctg caa cga gag gtg ttt     1288
Phe Leu Val Ser Pro Ile Asp Arg Asp Thr Leu Gln Arg Glu Val Phe
    350                 355                 360

cca ctt acg atc gtc gct tac aaa tat gat gag gag gcc ttc tcc aca     1336
Pro Leu Thr Ile Val Ala Tyr Lys Tyr Asp Glu Glu Ala Phe Ser Thr
365                 370                 375                 380

tca aca aac gtg gtc atc att gtg aca gac atc aac gac caa aga cct     1384
Ser Thr Asn Val Val Ile Ile Val Thr Asp Ile Asn Asp Gln Arg Pro
                385                 390                 395

gaa cct ata cac aag gaa tat cga ctg gca atc atg gag gag acg ccc     1432
Glu Pro Ile His Lys Glu Tyr Arg Leu Ala Ile Met Glu Glu Thr Pro
            400                 405                 410

ctg acc ctc aac ttc gat aaa gaa ttc gga ttt cat gat aag gat tta     1480
Leu Thr Leu Asn Phe Asp Lys Glu Phe Gly Phe His Asp Lys Asp Leu
        415                 420                 425

ggt caa aac gct cag tac acg gtg cgt cta gag agc gtg gac cct cca     1528
Gly Gln Asn Ala Gln Tyr Thr Val Arg Leu Glu Ser Val Asp Pro Pro
    430                 435                 440

ggc gct gct gag gca ttc tac ata gcg cct gaa gtc ggc tac cag cga     1576
Gly Ala Ala Glu Ala Phe Tyr Ile Ala Pro Glu Val Gly Tyr Gln Arg
445                 450                 455                 460

cag acc ttc atc atg ggc acc ctc aat cac tcc atg ctg gat tac gaa     1624
Gln Thr Phe Ile Met Gly Thr Leu Asn His Ser Met Leu Asp Tyr Glu
                465                 470                 475

gtg cca gag ttt cag agt att acg att cgg gtg gta gcg acc gac aac     1672
Val Pro Glu Phe Gln Ser Ile Thr Ile Arg Val Val Ala Thr Asp Asn
            480                 485                 490

aac gac acg agg cac gtg ggc gtc gcg ttg gtt cac att gac ctc atc     1720
Asn Asp Thr Arg His Val Gly Val Ala Leu Val His Ile Asp Leu Ile
        495                 500                 505

aat tgg aac gat gag cag ccg atc ttc gaa cac gcc gtg cag acc gtc     1768
Asn Trp Asn Asp Glu Gln Pro Ile Phe Glu His Ala Val Gln Thr Val
    510                 515                 520

acc ttc gac gag act gaa ggc gag ggg ttc ttc gtc gcc aag gcg gtt     1816
Thr Phe Asp Glu Thr Glu Gly Glu Gly Phe Phe Val Ala Lys Ala Val
525                 530                 535                 540

gca cac gac aga gac atc ggg gat gtc gtc gag cat act tta ttg ggt     1864
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Ala His Asp Arg Asp Ile Gly Asp Val Val Glu His Thr Leu Leu Gly
                545                 550                 555

aac gct gtt aac ttc ctg acc atc gac aaa ctc acc ggc gac atc cgc     1912
Asn Ala Val Asn Phe Leu Thr Ile Asp Lys Leu Thr Gly Asp Ile Arg
            560                 565                 570

gtc tca gct aac gac tcc ttc aac tac cat cga gaa agt gaa tta ttt     1960
Val Ser Ala Asn Asp Ser Phe Asn Tyr His Arg Glu Ser Glu Leu Phe
        575                 580                 585

gtg cag gtg cga gct aca gac acg ctg ggc gaa ccc ttc cac acg gcg     2008
Val Gln Val Arg Ala Thr Asp Thr Leu Gly Glu Pro Phe His Thr Ala
    590                 595                 600

acg tca cag ctg gtc ata cga cta aat gac atc aac aac acg cca ccc     2056
Thr Ser Gln Leu Val Ile Arg Leu Asn Asp Ile Asn Asn Thr Pro Pro
605                 610                 615                 620

acc tta cgg ctg cct cga ggc agt ccc caa gtg gag gag aac gtg cct     2104
Thr Leu Arg Leu Pro Arg Gly Ser Pro Gln Val Glu Glu Asn Val Pro
                625                 630                 635

gat ggc cac gtc atc acc cag gag tta cgc gcc acc gac ccc gac acc     2152
Asp Gly His Val Ile Thr Gln Glu Leu Arg Ala Thr Asp Pro Asp Thr
            640                 645                 650

acg gcc gat ctg cgc ttc gag ata aac tgg gac acc tct ttc gcc acc     2200
Thr Ala Asp Leu Arg Phe Glu Ile Asn Trp Asp Thr Ser Phe Ala Thr
        655                 660                 665

aag caa ggc cgc cag gct aac ccc gac gag ttt agg aat tgc gtg gaa     2248
Lys Gln Gly Arg Gln Ala Asn Pro Asp Glu Phe Arg Asn Cys Val Glu
    670                 675                 680

atc gag acc atc ttc ccc gag att aac aac cgg gga ctg gct atc ggc     2296
Ile Glu Thr Ile Phe Pro Glu Ile Asn Asn Arg Gly Leu Ala Ile Gly
685                 690                 695                 700

cgc gtt gta gcg cgc gaa atc aga cac aac gtg acc ata gac tac gag     2344
Arg Val Val Ala Arg Glu Ile Arg His Asn Val Thr Ile Asp Tyr Glu
                705                 710                 715

gag ttt gag gtc ctc tcc ctc aca gtg agg gtg cgt gac ctt aac acc     2392
Glu Phe Glu Val Leu Ser Leu Thr Val Arg Val Arg Asp Leu Asn Thr
            720                 725                 730

gtc tac gga gac gac tac gac gaa tcg atg ctc aca ata act ata atc     2440
Val Tyr Gly Asp Asp Tyr Asp Glu Ser Met Leu Thr Ile Thr Ile Ile
        735                 740                 745

gat atg aac gac aac gcg ccg gtg tgg gtg gag ggg act ctg gag cag     2488
Asp Met Asn Asp Asn Ala Pro Val Trp Val Glu Gly Thr Leu Glu Gln
    750                 755                 760

aac ttc cga gtc cgc gag atg tcg gcg ggc ggg ctc gtg gtg ggc tcc     2536
Asn Phe Arg Val Arg Glu Met Ser Ala Gly Gly Leu Val Val Gly Ser
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765                 770                 775                 780

gtg cgc gcg gac gac atc gac gga ccg ctc tac aac caa gtg cga tac     2584
Val Arg Ala Asp Asp Ile Asp Gly Pro Leu Tyr Asn Gln Val Arg Tyr
                785                 790                 795

acc att ttc cct cgt gaa gac aca gat aag gac ctg ata atg atc gac     2632
Thr Ile Phe Pro Arg Glu Asp Thr Asp Lys Asp Leu Ile Met Ile Asp
            800                 805                 810

ttc ctc acg ggt caa att tcc gtg aac aca agc ggc gcc atc gac gcg     2680
Phe Leu Thr Gly Gln Ile Ser Val Asn Thr Ser Gly Ala Ile Asp Ala
        815                 820                 825

gat act cct cca cgc ttc cac ctc tac tat aca gtg gtc gct agt gac     2728
Asp Thr Pro Pro Arg Phe His Leu Tyr Tyr Thr Val Val Ala Ser Asp
    830                 835                 840

cga tgc tcg aca gaa gat cct gca gat tgc ccc cct gac ccg act tat     2776
Arg Cys Ser Thr Glu Asp Pro Ala Asp Cys Pro Pro Asp Pro Thr Tyr
845                 850                 855                 860

tgg gaa acc gaa gga aat atc aca atc cac atc acc gac acg aac aac     2824
Trp Glu Thr Glu Gly Asn Ile Thr Ile His Ile Thr Asp Thr Asn Asn
                865                 870                 875

aag gtc ccg cag gcg gaa acg act aag ttc gat acc gtc gtg tat att     2872
Lys Val Pro Gln Ala Glu Thr Thr Lys Phe Asp Thr Val Val Tyr Ile
            880                 885                 890

tac gag aac gca acc cac tta gac gag gtg gtc act ctg ata gcc agt     2920
Tyr Glu Asn Ala Thr His Leu Asp Glu Val Val Thr Leu Ile Ala Ser
        895                 900                 905

gat ctt gac aga gac gaa ata tac cac acg gtg agc tac gtc atc aat     2968
Asp Leu Asp Arg Asp Glu Ile Tyr His Thr Val Ser Tyr Val Ile Asn
    910                 915                 920

tat gca gtg aac cct cga ctg atg aac ttc ttc tcc gtg aac cga gag     3016
Tyr Ala Val Asn Pro Arg Leu Met Asn Phe Phe Ser Val Asn Arg Glu
925                 930                 935                 940

acc ggc ctg gtg tac gtg gac tat gag acc cag ggt agt ggc gag gtg     3064
Thr Gly Leu Val Tyr Val Asp Tyr Glu Thr Gln Gly Ser Gly Glu Val
                945                 950                 955

ctg gac cgt gat ggt gat gaa cca acg cac cgt atc ttc ttc aac ctc     3112
Leu Asp Arg Asp Gly Asp Glu Pro Thr His Arg Ile Phe Phe Asn Leu
            960                 965                 970

atc gac aac ttc atg ggg gaa gga gaa ggt aac aga aat cag aac gac     3160
Ile Asp Asn Phe Met Gly Glu Gly Glu Gly Asn Arg Asn Gln Asn Asp
        975                 980                 985

aca gaa gtt ctc gtt atc ttg ttg gat gtg aat gac aat gct cct gaa     3208
Thr Glu Val Leu Val Ile Leu Leu Asp Val Asn Asp Asn Ala Pro Glu
    990                 995                 1000
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52

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ttg cca ccg ccg agc gaa ctc tct tgg act ata tct gag aac ctt aag     3256
Leu Pro Pro Pro Ser Glu Leu Ser Trp Thr Ile Ser Glu Asn Leu Lys
1005                1010                1015                1020

cag ggc gtc cgt ctt gaa cca cat atc ttc gcc ccg gac cgc gac gag     3304
Gln Gly Val Arg Leu Glu Pro His Ile Phe Ala Pro Asp Arg Asp Glu
                1025                1030                1035

ccc gac aca gac aac tcc agg gtc ggc tac gag atc ctg aac ctc agc     3352
Pro Asp Thr Asp Asn Ser Arg Val Gly Tyr Glu Ile Leu Asn Leu Ser
            1040                1045                1050

acg gag cgg gac atc gaa gtg ccg gag ctg ttt gtg atg ata cag atc     3400
Thr Glu Arg Asp Ile Glu Val Pro Glu Leu Phe Val Met Ile Gln Ile
        1055                1060                1065

gcg aac gtc acg gga gag ctg gag acc gcc atg gac ctc aag gga tat     3448
Ala Asn Val Thr Gly Glu Leu Glu Thr Ala Met Asp Leu Lys Gly Tyr
    1070                1075                1080

tgg ggg acg tac gct ata cat ata cgg gca ttc gac cac ggc att ccg     3496
Trp Gly Thr Tyr Ala Ile His Ile Arg Ala Phe Asp His Gly Ile Pro
1085                1090                1095                1100

caa atg tcc atg aac gag aca tat gag ctg atc atc cat ccg ttc aac     3544
Gln Met Ser Met Asn Glu Thr Tyr Glu Leu Ile Ile His Pro Phe Asn
                1105                1110                1115

tac tac gcg cct gag ttc gtc ttc ccg acc aac gat gcc gtc ata cga     3592
Tyr Tyr Ala Pro Glu Phe Val Phe Pro Thr Asn Asp Ala Val Ile Arg
            1120                1125                1130

ctt gcg agg gaa cga gct gta atc aat gga gtt cta gcg aca gtg aac     3640
Leu Ala Arg Glu Arg Ala Val Ile Asn Gly Val Leu Ala Thr Val Asn
        1135                1140                1145

gga gag ttc ttg gag cgg ata tcg gcg act gat ccg gac gga ctc cac     3688
Gly Glu Phe Leu Glu Arg Ile Ser Ala Thr Asp Pro Asp Gly Leu His
    1150                1155                1160

gcg ggc gtc gtc acc ttc caa gtg gta ggc gat gag gaa tca caa cgg     3736
Ala Gly Val Val Thr Phe Gln Val Val Gly Asp Glu Glu Ser Gln Arg
1165                1170                1175                1180

tac ttt caa gta gtt aac gat ggc gag aac ctc ggc tcg ttg agg tta     3784
Tyr Phe Gln Val Val Asn Asp Gly Glu Asn Leu Gly Ser Leu Arg Leu
                1185                1190                1195

ctg caa gcc gtt cca gag gag atc agg gag ttc cgg ata acg att cgc     3832
Leu Gln Ala Val Pro Glu Glu Ile Arg Glu Phe Arg Ile Thr Ile Arg
            1200                1205                1210

gct aca gac cag gga acg gac cca gga ccg ctg tcc acg gac atg acg     3880
Ala Thr Asp Gln Gly Thr Asp Pro Gly Pro Leu Ser Thr Asp Met Thr
        1215                1220                1225
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ttc aga gtt gtt ttt gtg ccc acg caa gga gaa cct aga ttc gcg tcc     3928
Phe Arg Val Val Phe Val Pro Thr Gln Gly Glu Pro Arg Phe Ala Ser
    1230                1235                1240

tca gaa cat gct gtc gct ttc ata gaa aag agt gcc ggc atg gaa gag     3976
Ser Glu His Ala Val Ala Phe Ile Glu Lys Ser Ala Gly Met Glu Glu
1245                1250                1255                1260

tct cac caa ctt cct cta gca caa gac atc aag aac cat ctc tgt gaa     4024
Ser His Gln Leu Pro Leu Ala Gln Asp Ile Lys Asn His Leu Cys Glu
                1265                1270                1275

gac gac tgt cac agc att tac tat cgt att atc gat ggc aac agc gaa     4072
Asp Asp Cys His Ser Ile Tyr Tyr Arg Ile Ile Asp Gly Asn Ser Glu
            1280                1285                1290

ggt cat ttc ggc ctg gat cct gtt cgc aac agg ttg ttc ctg aag aaa     4120
Gly His Phe Gly Leu Asp Pro Val Arg Asn Arg Leu Phe Leu Lys Lys
        1295                1300                1305

gag ctg ata agg gaa caa agt gcc tcc cac act ctg caa gtg gcg gct     4168
Glu Leu Ile Arg Glu Gln Ser Ala Ser His Thr Leu Gln Val Ala Ala
    1310                1315                1320

agt aac tcg ccc gat ggt ggc att cca ctt cct gct tcc atc ctt act     4216
Ser Asn Ser Pro Asp Gly Gly Ile Pro Leu Pro Ala Ser Ile Leu Thr
1325                1330                1335                1340

gtc act gtt acc gtg agg gag gca gac cct cgt cca gtg ttt gtg agg     4264
Val Thr Val Thr Val Arg Glu Ala Asp Pro Arg Pro Val Phe Val Arg
                1345                1350                1355

gaa ttg tac acc gca ggg ata tcc aca gcg gac tcc atc ggc aga gag     4312
Glu Leu Tyr Thr Ala Gly Ile Ser Thr Ala Asp Ser Ile Gly Arg Glu
            1360                1365                1370

ctg ctc aga tta cat gcg acc cag tct gaa ggc tcg gcc att act tat     4360
Leu Leu Arg Leu His Ala Thr Gln Ser Glu Gly Ser Ala Ile Thr Tyr
        1375                1380                1385

gct ata gac tac gat aca atg gta gtg gac ccc agc ctg gag gca gtg     4408
Ala Ile Asp Tyr Asp Thr Met Val Val Asp Pro Ser Leu Glu Ala Val
    1390                1395                1400

aga cag tcg gct ttc gta ctg aac gct caa acc gga gtg ctg acg ctt     4456
Arg Gln Ser Ala Phe Val Leu Asn Ala Gln Thr Gly Val Leu Thr Leu
1405                1410                1415                1420

aat atc cag ccc acg gcc acg atg cat gga ctg ttc aaa ttc gaa gtc     4504
Asn Ile Gln Pro Thr Ala Thr Met His Gly Leu Phe Lys Phe Glu Val
                1425                1430                1435

aca gct act gac acg gcc ggc gct cag gac cgc acc gac gtc acc gtg     4552
Thr Ala Thr Asp Thr Ala Gly Ala Gln Asp Arg Thr Asp Val Thr Val
            1440                1445                1450

tac gtg gta tcc tcg cag aac cgc gtc tac ttc gtg ttc gtc aac acg     4600
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54

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Tyr Val Val Ser Ser Gln Asn Arg Val Tyr Phe Val Phe Val Asn Thr
        1455                1460                1465

ctg caa cag gtc gaa gac aac aga gac ttt atc gcg gac acc ttc agc     4648
Leu Gln Gln Val Glu Asp Asn Arg Asp Phe Ile Ala Asp Thr Phe Ser
    1470                1475                1480

gct ggg ttc aac atg acc tgc aac atc gac caa gtg gtg ccc gct aac     4696
Ala Gly Phe Asn Met Thr Cys Asn Ile Asp Gln Val Val Pro Ala Asn
1485                1490                1495                1500

gac ccc gtc acc ggc gtg gcg ctg gag cac agc acg cag atg cgc ggc     4744
Asp Pro Val Thr Gly Val Ala Leu Glu His Ser Thr Gln Met Arg Gly
                1505                1510                1515

cac ttc ata cgg gac aac gta ccc gta ctc gct gat gag ata gaa cag     4792
His Phe Ile Arg Asp Asn Val Pro Val Leu Ala Asp Glu Ile Glu Gln
            1520                1525                1530

atc cgt agt gac cta gtc ctc ctg agc tcg ata caa aca acg ctg gcg     4840
Ile Arg Ser Asp Leu Val Leu Leu Ser Ser Ile Gln Thr Thr Leu Ala
        1535                1540                1545

gcg cga tcg ctg gtg ttg cag gac ttg ttg acc aac tcc agc ccg gac     4888
Ala Arg Ser Leu Val Leu Gln Asp Leu Leu Thr Asn Ser Ser Pro Asp
    1550                1555                1560

tcg gcg cct gac tcg agc ctc acg gtg tac gtg ctg gcc tca ctg tct     4936
Ser Ala Pro Asp Ser Ser Leu Thr Val Tyr Val Leu Ala Ser Leu Ser
1565                1570                1575                1580

gct gtg ctc ggt ttc atg tgc ctt gtg cta ctg ctt acc ttc atc atc     4984
Ala Val Leu Gly Phe Met Cys Leu Val Leu Leu Leu Thr Phe Ile Ile
                1585                1590                1595

agg act aga gcg cta aac cga cgg ttg gaa gcc ctg tcg atg acg aag     5032
Arg Thr Arg Ala Leu Asn Arg Arg Leu Glu Ala Leu Ser Met Thr Lys
            1600                1605                1610

tac ggc tca ctg gac tct gga ttg aac cgc gcc ggc atc gcc gcc ccc     5080
Tyr Gly Ser Leu Asp Ser Gly Leu Asn Arg Ala Gly Ile Ala Ala Pro
        1615                1620                1625

ggc acc aac aaa cac act gtg gaa ggc tcc aac cct atc ttc aat gaa     5128
Gly Thr Asn Lys His Thr Val Glu Gly Ser Asn Pro Ile Phe Asn Glu
    1630                1635                1640

gca ata aag acg cca gat tta gat gcc att agc gag ggt tcc aac gac     5176
Ala Ile Lys Thr Pro Asp Leu Asp Ala Ile Ser Glu Gly Ser Asn Asp
1645                1650                1655                1660

tct gat ctg atc ggc atc gaa gat ctt ccg cac ttt ggc aac gtc ttc     5224
Ser Asp Leu Ile Gly Ile Glu Asp Leu Pro His Phe Gly Asn Val Phe
                1665                1670                1675

atg gat cct gag gtg aac gaa aag gca aat ggt tat ccc gaa gtc gca     5272
Met Asp Pro Glu Val Asn Glu Lys Ala Asn Gly Tyr Pro Glu Val Ala
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55

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            1680                1685                1690

aac cac aac aac aac ttc gct ttc aac ccg act ccc ttc tcg cct gag     5320
Asn His Asn Asn Asn Phe Ala Phe Asn Pro Thr Pro Phe Ser Pro Glu
        1695                1700                1705

ttc gtt aac gga cag ttc aga aag atc t agaagataac aacactagtt        5368
Phe Val Asn Gly Gln Phe Arg Lys Ile
    1710                1715

aagatcatta attttggagt ttggaattaa gatttttgaa aggatagttg tgataagcct   5428
gtgatttta aaactgtaat tgaaaaaaaa aattgagacc tccatttaag ctcttgctct   5488
catctcatca aattttataa aatgccatta gtcattaaga tactcgattt aatttaagat   5548
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Pro Ala Val Leu Ala Gln Glu Arg Cys Gly Tyr Met Thr Ala Ile Pro
            20                  25                  30
Arg Leu Pro Arg Pro Asp Asn Leu Pro Val Leu Asn Phe Glu Gly Gln
        35                  40                  45
Thr Trp Ser Gln Arg Pro Leu Leu Pro Ala Pro Glu Arg Asp Asp Leu
    50                  55                  60
Cys Met Asp Ala Tyr His Val Ile Thr Ala Asn Leu Gly Thr Gln Val
65                  70                  75                  80
Ile Tyr Met Asp Glu Glu Ile Glu Asp Glu Ile Thr Ile Ala Ile Leu
                85                  90                  95
Asn Tyr Asn Gly Pro Ser Thr Pro Phe Ile Glu Leu Pro Phe Leu Ser
            100                 105                 110
Gly Ser Tyr Asn Leu Leu Met Pro Val Ile Arg Arg Val Asp Asn Gly
        115                 120                 125
Glu Trp His Leu Ile Ile Thr Gln Arg Gln His Tyr Glu Leu Pro Gly
    130                 135                 140
Met Gln Gln Tyr Met Phe Asn Val Arg Val Asp Gly Gln Ser Leu Val
145                 150                 155                 160
Ala Gly Val Ser Leu Ala Ile Val Asn Ile Asp Asp Asn Ala Pro Ile
                165                 170                 175
Ile Gln Asn Phe Glu Pro Cys Arg Val Pro Glu Leu Gly Glu Pro Gly
            180                 185                 190
Leu Thr Glu Cys Thr Tyr Gln Val Ser Asp Ala Asp Gly Arg Ile Ser
        195                 200                 205
Thr Glu Phe Met Thr Phe Arg Ile Asp Ser Val Arg Gly Asp Glu Glu
    210                 215                 220
Thr Phe Tyr Ile Glu Arg Thr Asn Ile Pro Asn Gln Trp Met Trp Leu
225                 230                 235                 240
Asn Met Thr Ile Gly Val Asn Thr Ser Leu Asn Phe Val Thr Ser Pro
                245                 250                 255
Leu His Ile Phe Ser Val Thr Ala Leu Asp Ser Leu Pro Asn Thr His
            260                 265                 270
Thr Val Thr Met Met Val Gln Val Ala Asn Val Asn Ser Arg Pro Pro
        275                 280                 285
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30

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Arg Trp Leu Glu Ile Phe Ala Val Gln Gln Phe Glu Glu Lys Ser Tyr
    290                 295                 300
Gln Asn Phe Thr Val Arg Ala Ile Asp Gly Asp Thr Glu Ile Asn Met
305                 310                 315                 320
Pro Ile Asn Tyr Arg Leu Ile Thr Asn Glu Glu Asp Thr Phe Phe Ser
                325                 330                 335
Ile Glu Ala Leu Pro Gly Gly Lys Ser Gly Ala Val Phe Leu Val Ser
            340                 345                 350
Pro Ile Asp Arg Asp Thr Leu Gln Arg Glu Val Phe Pro Leu Thr Ile
        355                 360                 365
Val Ala Tyr Lys Tyr Asp Glu Glu Ala Phe Ser Thr Ser Thr Asn Val
    370                 375                 380
Val Ile Ile Val Thr Asp Ile Asn Asp Gln Arg Pro Glu Pro Ile His
385                 390                 395                 400
Lys Glu Tyr Arg Leu Ala Ile Met Glu Glu Thr Pro Leu Thr Leu Asn
                405                 410                 415
Phe Asp Lys Glu Phe Gly Phe His Asp Lys Asp Leu Gly Gln Asn Ala
            420                 425                 430
Gln Tyr Thr Val Arg Leu Glu Ser Val Asp Pro Pro Gly Ala Ala Glu
        435                 440                 445
Ala Phe Tyr Ile Ala Pro Glu Val Gly Tyr Gln Arg Gln Thr Phe Ile
    450                 455                 460
Met Gly Thr Leu Asn His Ser Met Leu Asp Tyr Glu Val Pro Glu Phe
465                 470                 475                 480
Gln Ser Ile Thr Ile Arg Val Val Ala Thr Asp Asn Asn Asp Thr Arg
                485                 490                 495
His Val Gly Val Ala Leu Val His Ile Asp Leu Ile Asn Trp Asn Asp
            500                 505                 510
Glu Gln Pro Ile Phe Glu His Ala Val Gln Thr Val Thr Phe Asp Glu
        515                 520                 525
Thr Glu Gly Glu Gly Phe Phe Val Ala Lys Ala Val Ala His Asp Arg
    530                 535                 540
Asp Ile Gly Asp Val Val Glu His Thr Leu Leu Gly Asn Ala Val Asn
545                 550                 555                 560
Phe Leu Thr Ile Asp Lys Leu Thr Gly Asp Ile Arg Val Ser Ala Asn
                565                 570                 575
Asp Ser Phe Asn Tyr His Arg Glu Ser Glu Leu Phe Val Gln Val Arg
            580                 585                 590
Ala Thr Asp Thr Leu Gly Glu Pro Phe His Thr Ala Thr Ser Gln Leu
        595                 600                 605
Val Ile Arg Leu Asn Asp Ile Asn Asn Thr Pro Pro Thr Leu Arg Leu
    610                 615                 620
Pro Arg Gly Ser Pro Gln Val Glu Glu Asn Val Pro Asp Gly His Val
625                 630                 635                 640
Ile Thr Gln Glu Leu Arg Ala Thr Asp Pro Asp Thr Thr Ala Asp Leu
                645                 650                 655
Arg Phe Glu Ile Asn Trp Asp Thr Ser Phe Ala Thr Lys Gln Gly Arg
            660                 665                 670
Gln Ala Asn Pro Asp Glu Phe Arg Asn Cys Val Glu Ile Glu Thr Ile
        675                 680                 685
Phe Pro Glu Ile Asn Asn Arg Gly Leu Ala Ile Gly Arg Val Val Ala
    690                 695                 700
Arg Glu Ile Arg His Asn Val Thr Ile Asp Tyr Glu Glu Phe Glu Val
705                 710                 715                 720
Leu Ser Leu Thr Val Arg Val Arg Asp Leu Asn Thr Val Tyr Gly Asp
                725                 730                 735
Asp Tyr Asp Glu Ser Met Leu Thr Ile Thr Ile Ile Asp Met Asn Asp
```


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B

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            740                 745                 750
Asn Ala Pro Val Trp Val Glu Gly Thr Leu Glu Gln Asn Phe Arg Val
        755                 760                 765
Arg Glu Met Ser Ala Gly Gly Leu Val Val Gly Ser Val Arg Ala Asp
    770                 775                 780
Asp Ile Asp Gly Pro Leu Tyr Asn Gln Val Arg Tyr Thr Ile Phe Pro
785                 790                 795                 800
Arg Glu Asp Thr Asp Lys Asp Leu Ile Met Ile Asp Phe Leu Thr Gly
                805                 810                 815
Gln Ile Ser Val Asn Thr Ser Gly Ala Ile Asp Ala Asp Thr Pro Pro
            820                 825                 830
Arg Phe His Leu Tyr Tyr Thr Val Val Ala Ser Asp Arg Cys Ser Thr
        835                 840                 845
Glu Asp Pro Ala Asp Cys Pro Pro Asp Pro Thr Tyr Trp Glu Thr Glu
    850                 855                 860
Gly Asn Ile Thr Ile His Ile Thr Asp Thr Asn Asn Lys Val Pro Gln
865                 870                 875                 880
Ala Glu Thr Thr Lys Phe Asp Thr Val Val Tyr Ile Tyr Glu Asn Ala
                885                 890                 895
Thr His Leu Asp Glu Val Val Thr Leu Ile Ala Ser Asp Leu Asp Arg
            900                 905                 910
Asp Glu Ile Tyr His Thr Val Ser Tyr Val Ile Asn Tyr Ala Val Asn
        915                 920                 925
Pro Arg Leu Met Asn Phe Phe Ser Val Asn Arg Glu Thr Gly Leu Val
    930                 935                 940
Tyr Val Asp Tyr Glu Thr Gln Gly Ser Gly Glu Val Leu Asp Arg Asp
945                 950                 955                 960
Gly Asp Glu Pro Thr His Arg Ile Phe Phe Asn Leu Ile Asp Asn Phe
                965                 970                 975
Met Gly Glu Gly Glu Gly Asn Arg Asn Gln Asn Asp Thr Glu Val Leu
            980                 985                 990
Val Ile Leu Leu Asp Val Asn Asp Asn Ala Pro Glu Leu Pro Pro Pro
        995                 1000                1005
Ser Glu Leu Ser Trp Thr Ile Ser Glu Asn Leu Lys Gln Gly Val Arg
    1010                1015                1020
Leu Glu Pro His Ile Phe Ala Pro Asp Arg Asp Glu Pro Asp Thr Asp
1025                1030                1035                1040
Asn Ser Arg Val Gly Tyr Glu Ile Leu Asn Leu Ser Thr Glu Arg Asp
                1045                1050                1055
Ile Glu Val Pro Glu Leu Phe Val Met Ile Gln Ile Ala Asn Val Thr
            1060                1065                1070
Gly Glu Leu Glu Thr Ala Met Asp Leu Lys Gly Tyr Trp Gly Thr Tyr
        1075                1080                1085
Ala Ile His Ile Arg Ala Phe Asp His Gly Ile Pro Gln Met Ser Met
    1090                1095                1100
Asn Glu Thr Tyr Glu Leu Ile Ile His Pro Phe Asn Tyr Tyr Ala Pro
1105                1110                1115                1120
Glu Phe Val Phe Pro Thr Asn Asp Ala Val Ile Arg Leu Ala Arg Glu
                1125                1130                1135
Arg Ala Val Ile Asn Gly Val Leu Ala Thr Val Asn Gly Glu Phe Leu
            1140                1145                1150
Glu Arg Ile Ser Ala Thr Asp Pro Asp Gly Leu His Ala Gly Val Val
        1155                1160                1165
Thr Phe Gln Val Val Gly Asp Glu Glu Ser Gln Arg Tyr Phe Gln Val
    1170                1175                1180
Val Asn Asp Gly Glu Asn Leu Gly Ser Leu Arg Leu Leu Gln Ala Val
1185                1190                1195                1200
```

Pro Glu Glu Ile Arg Glu Phe Arg Ile Thr Ile Arg Ala Thr Asp Gln
1205 1210 1215
Gly Thr Asp Pro Gly Pro Leu Ser Thr Asp Met Thr Phe Arg Val Val
1220 1225 1230
Phe Val Pro Thr Gln Gly Glu Pro Arg Phe Ala Ser Ser Glu His Ala
1235 1240 1245
Val Ala Phe Ile Glu Lys Ser Ala Gly Met Glu Glu Ser His Gln Leu
1250 1255 1260
Pro Leu Ala Gln Asp Ile Lys Asn His Leu Cys Glu Asp Asp Cys His
1265 1270 1275 1280
Ser Ile Tyr Tyr Arg Ile Ile Asp Gly Asn Ser Glu Gly His Phe Gly
1285 1290 1295
Leu Asp Pro Val Arg Asn Arg Leu Phe Leu Lys Lys Glu Leu Ile Arg
1300 1305 1310
Glu Gln Ser Ala Ser His Thr Leu Gln Val Ala Ala Ser Asn Ser Pro
1315 1320 1325
Asp Gly Gly Ile Pro Leu Pro Ala Ser Ile Leu Thr Val Thr Val Thr
1330 1335 1340
Val Arg Glu Ala Asp Pro Arg Pro Val Phe Val Arg Glu Leu Tyr Thr
1345 1350 1355 1360
Ala Gly Ile Ser Thr Ala Asp Ser Ile Gly Arg Glu Leu Leu Arg Leu
1365 1370 1375
His Ala Thr Gln Ser Glu Gly Ser Ala Ile Thr Tyr Ala Ile Asp Tyr
1380 1385 1390
Asp Thr Met Val Val Asp Pro Ser Leu Glu Ala Val Arg Gln Ser Ala
1395 1400 1405
Phe Val Leu Asn Ala Gln Thr Gly Val Leu Thr Leu Asn Ile Gln Pro
1410 1415 1420
Thr Ala Thr Met His Gly Leu Phe Lys Phe Glu Val Thr Ala Thr Asp
1425 1430 1435 1440
Thr Ala Gly Ala Gln Asp Arg Thr Asp Val Thr Val Tyr Val Val Ser
1445 1450 1455
Ser Gln Asn Arg Val Tyr Phe Val Phe Val Asn Thr Leu Gln Gln Val
1460 1465 1470
Glu Asp Asn Arg Asp Phe Ile Ala Asp Thr Phe Ser Ala Gly Phe Asn
1475 1480 1485
Met Thr Cys Asn Ile Asp Gln Val Val Pro Ala Asn Asp Pro Val Thr
1490 1495 1500
Gly Val Ala Leu Glu His Ser Thr Gln Met Arg Gly His Phe Ile Arg
1505 1510 1515 1520
Asp Asn Val Pro Val Leu Ala Asp Glu Ile Glu Gln Ile Arg Ser Asp
1525 1530 1535
Leu Val Leu Leu Ser Ser Ile Gln Thr Thr Leu Ala Ala Arg Ser Leu
1540 1545 1550
Val Leu Gln Asp Leu Leu Thr Asn Ser Ser Pro Asp Ser Ala Pro Asp
1555 1560 1565
Ser Ser Leu Thr Val Tyr Val Leu Ala Ser Leu Ser Ala Val Leu Gly
1570 1575 1580
Phe Met Cys Leu Val Leu Leu Leu Thr Phe Ile Ile Arg Thr Arg Ala
1585 1590 1595 1600
Leu Asn Arg Arg Leu Glu Ala Leu Ser Met Thr Lys Tyr Gly Ser Leu
1605 1610 1615
Asp Ser Gly Leu Asn Arg Ala Gly Ile Ala Ala Pro Gly Thr Asn Lys
1620 1625 1630
His Thr Val Glu Gly Ser Asn Pro Ile Phe Asn Glu Ala Ile Lys Thr
1635 1640 1645
Pro Asp Leu Asp Ala Ile Ser Glu Gly Ser Asn Asp Ser Asp Leu Ile

```
    1650                1655                1660
Gly Ile Glu Asp Leu Pro His Phe Gly Asn Val Phe Met Asp Pro Glu
1665                1670                1675                1680
Val Asn Glu Lys Ala Asn Gly Tyr Pro Glu Val Ala Asn His Asn Asn
                1685                1690                1695
Asn Phe Ala Phe Asn Pro Thr Pro Phe Ser Pro Glu Phe Val Asn Gly
            1700                1705                1710
Gln Phe Arg Lys Ile
        1715
```

<210> 3
<211> 30
<212> PRT
<213> M. sexta

<400> 3
Met Leu Asp Tyr Glu Val Pro Glu Phe Gln Ser Ile Thr Ile Arg Val
 1   5   10   15
Val Ala Thr Asp Asn Asn Asp Thr Arg His Val Gly Val Ala
            20   25   30

<210> 4
<211> 16
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(16)
<223> Xaa = Any Amino Acid

<400> 4
Met Xaa Glu Thr Tyr Glu Leu Ile Ile His Pro Phe Asn Tyr Tyr Ala
 1   5   10   15

<210> 5
<211> 16
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(16)
<223> Xaa = Any Amino Acid

<400> 5
Met Xaa Xaa Xaa His Gln Leu Pro Leu Ala Gln Asp Ile Lys Asn His
 1   5   10   15

<210> 6
<211> 8
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(8)

60

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<223> Xaa = Any Amino Acid

<400> 6
Met Xaa Xaa Val Xaa Val Asp Xaa
 1   5

<210> 7
<211> 9
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(9)
<223> Xaa = Any Amino Acid

<400> 7
Met Asn Phe Xaa Ser Val Asn Xaa Glu
 1   5

<210> 8
<211> 109
<212> PRT
<213> Mouse

<400> 8
Glu Trp Val Met Pro Pro Ile Phe Val Pro Glu Asn Gly Lys Gly Pro
 1   5   10   15
Phe Pro Gln Arg Leu Asn Gln Leu Lys Ser Asn Lys Asp Arg Gly Thr
            20   25   30
Lys Ile Phe Tyr Tyr Ser Ile Thr Gly Pro Gly Ala Asp Ser Pro Pro
        35   40   45
Glu Gly Val Phe Thr Ile Glu Lys Glu Ser Gly Trp Leu Leu Leu His
    50   55   60
Met Pro Leu Asp Arg Glu Lys Ile Val Lys Tyr Glu Leu Tyr Gly His
65   70   75   80
Ala Val Ser Glu Asn Gly Ala Ser Val Glu Glu Pro Met Asn Ile Ser
                85   90   95
Ile Ile Val Thr Asp Gln Asn Asp Asn Lys Pro Lys Phe
            100   105

<210> 9
<211> 105
<212> PRT
<213> Drosophila

<400> 9
Glu Asp Thr Val Tyr Ser Phe Asp Ile Asp Glu Asn Ala Gln Arg Gly
 1   5   10   15
Tyr Gln Val Gly Gln Ile Val Ala Arg Asp Ala Asp Leu Gly Gln Asn
            20   25   30
Ala Gln Leu Ser Tyr Gly Val Val Ser Asp Trp Ala Asn Asp Val Phe
        35   40   45
Ser Leu Asn Pro Gln Thr Gly Met Leu Thr Leu Thr Ala Arg Leu Asp
    50   55   60
Tyr Glu Glu Val Gln His Tyr Ile Leu Ile Val Gln Ala Gln Asp Asn
65   70   75   80

```
Gly Gln Pro Ser Leu Ser Thr Thr Ile Thr Val Tyr Cys Asn Val Leu
                85                  90                  95
Asp Leu Asn Asp Asn Ala Pro Ile Phe
            100                 105

<210> 10
<211> 92
<212> PRT
<213> Protocadherin

<400> 10
Ala Ser Pro Val Ile Thr Leu Ala Ile Pro Glu Asn Thr Asn Gly Ser
 1               5                  10                  15
Leu Phe Pro Ile Pro Leu Ala Ser Asp Arg Asp Ala Asn Glu Leu Gln
            20                  25                  30
Val Ala Glu Asp Gln Glu Glu Lys Gln Pro Gln Leu Ile Val Met Gly
        35                  40                  45
Asn Leu Asp Arg Glu Arg Trp Asp Ser Tyr Asp Leu Thr Ile Lys Val
    50                  55                  60
Gln Asp Gly Gly Ser Pro Pro Arg Ala Thr Ser Ala Leu Leu Arg Val
65                  70                  75                  80
Thr Val Leu Asp Thr Asn Asp Asn Ala Pro Lys Phe
                85                  90

<210> 11
<211> 106
<212> PRT
<213> M. sexta

<400> 11
Ile Val Thr Glu Asn Ile Trp Lys Ala Pro Lys Pro Val Glu Met Val
 1               5                  10                  15
Glu Asn Ser Thr Pro His Pro Ile Lys Ile Thr Gln Val Arg Trp Asn
            20                  25                  30
Asp Pro Gly Ala Gln Tyr Ser Leu Val Asp Lys Glu Lys Leu Pro Arg
        35                  40                  45
Phe Pro Phe Ser Ile Asp Gln Glu Gly Asp Ile Tyr Val Thr Gln Pro
    50                  55                  60
Ile Asp Arg Glu Glu Lys Asp Ala Tyr Val Phe Tyr Ala Val Ala Lys
65                  70                  75                  80
Asp Glu Tyr Gly Lys Pro Leu Ser Tyr Pro Leu Glu Ile His Val Lys
                85                  90                  95
Val Lys Asp Asn Asp Asn Pro Pro Thr Cys
            100                 105

<210> 12
<211> 5
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(5)
<223> Xaa = Any Amino Acid

<400> 12
Ala Xaa Asp Xaa Asp
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1 5

<210> 13
<211> 7
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(7)
<223> Xaa = Any Amino Acid

<400> 13
Asp Xaa Asn Asp Xaa Xaa Pro
1 5

<210> 14
<211> 5
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(5)
<223> Xaa = Any Amino Acid

<400> 14
Xaa Xaa Asp Xaa Asp
1 5

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<210> 15
<211> 5
<212> PRT
<213> M. sexta

<220>
<221> VARIANT
<222> (1)...(5)
<223> Xaa = Any Amino Acid

<400> 15
Asp Xaa Asn Asp Asn
1 5

B